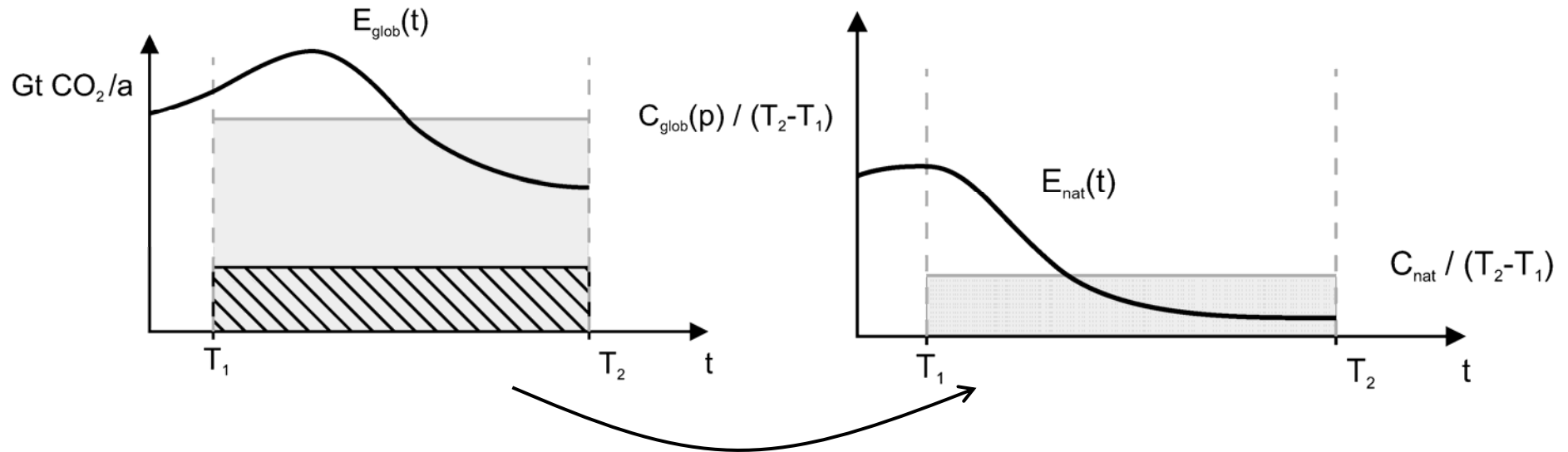


# “World Formula“ for Climate Policy

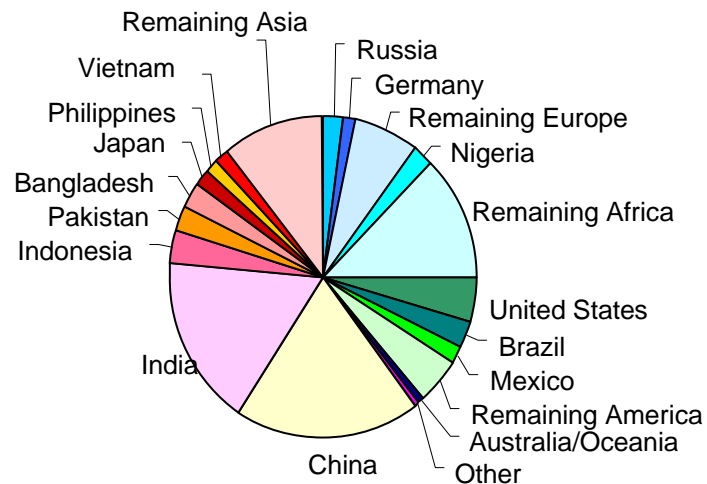
## Illustration



Global carbon budget

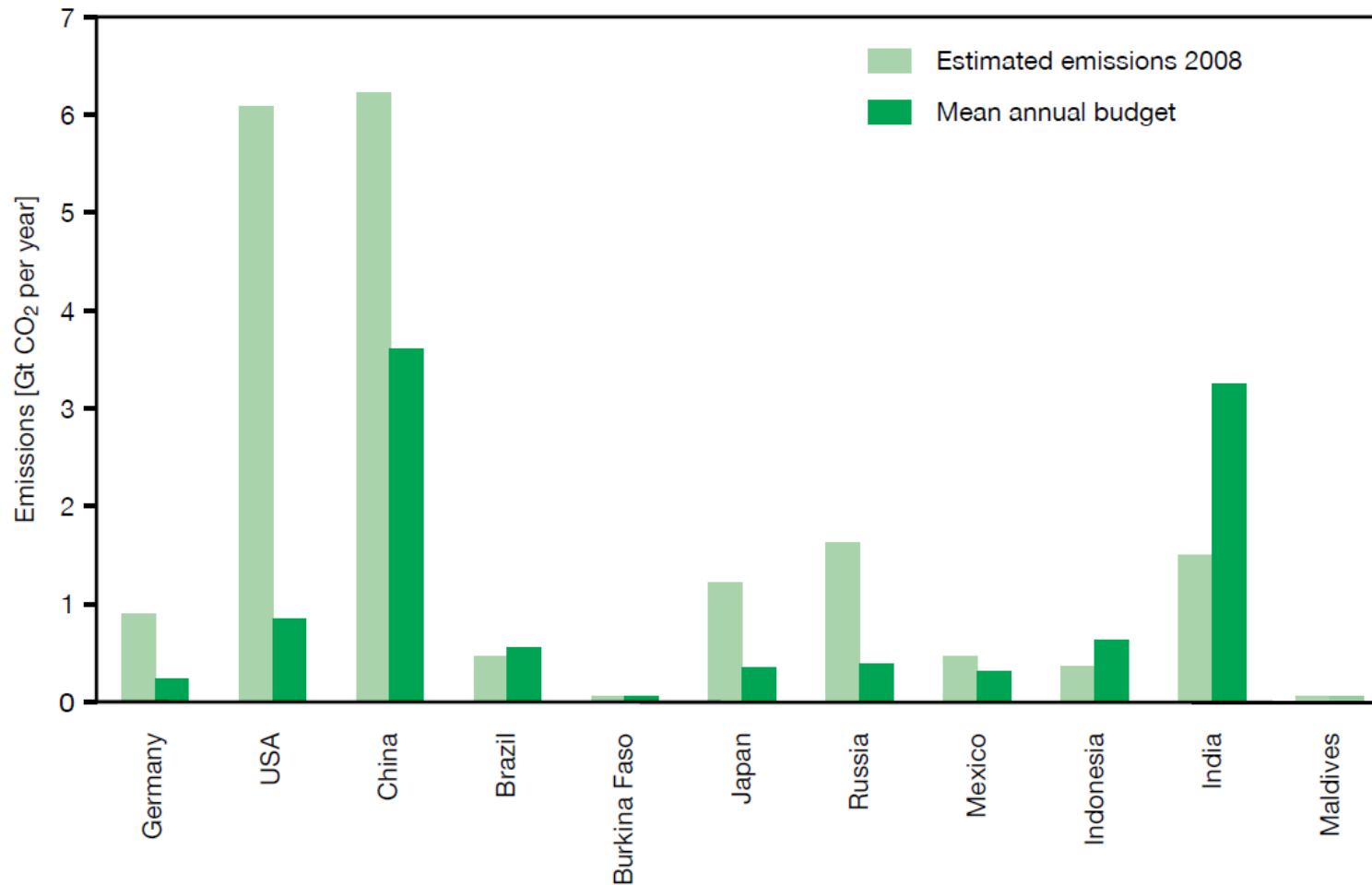
Share in world population

National carbon budget



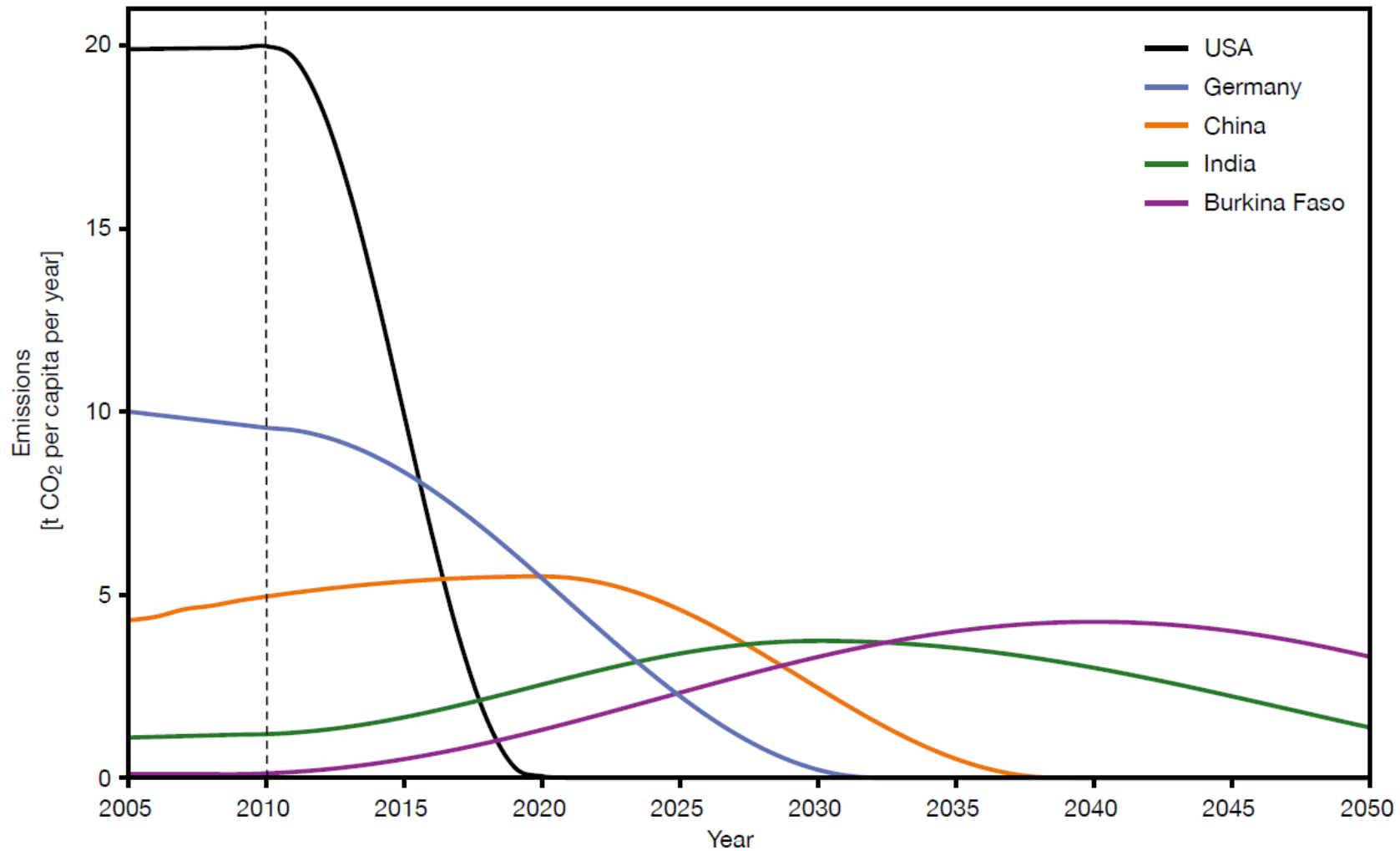
## Scenario 2: Future responsibility approach

$$T_1 = 2010, T_2 = 2050, T_M = 2010, p = 2/3$$



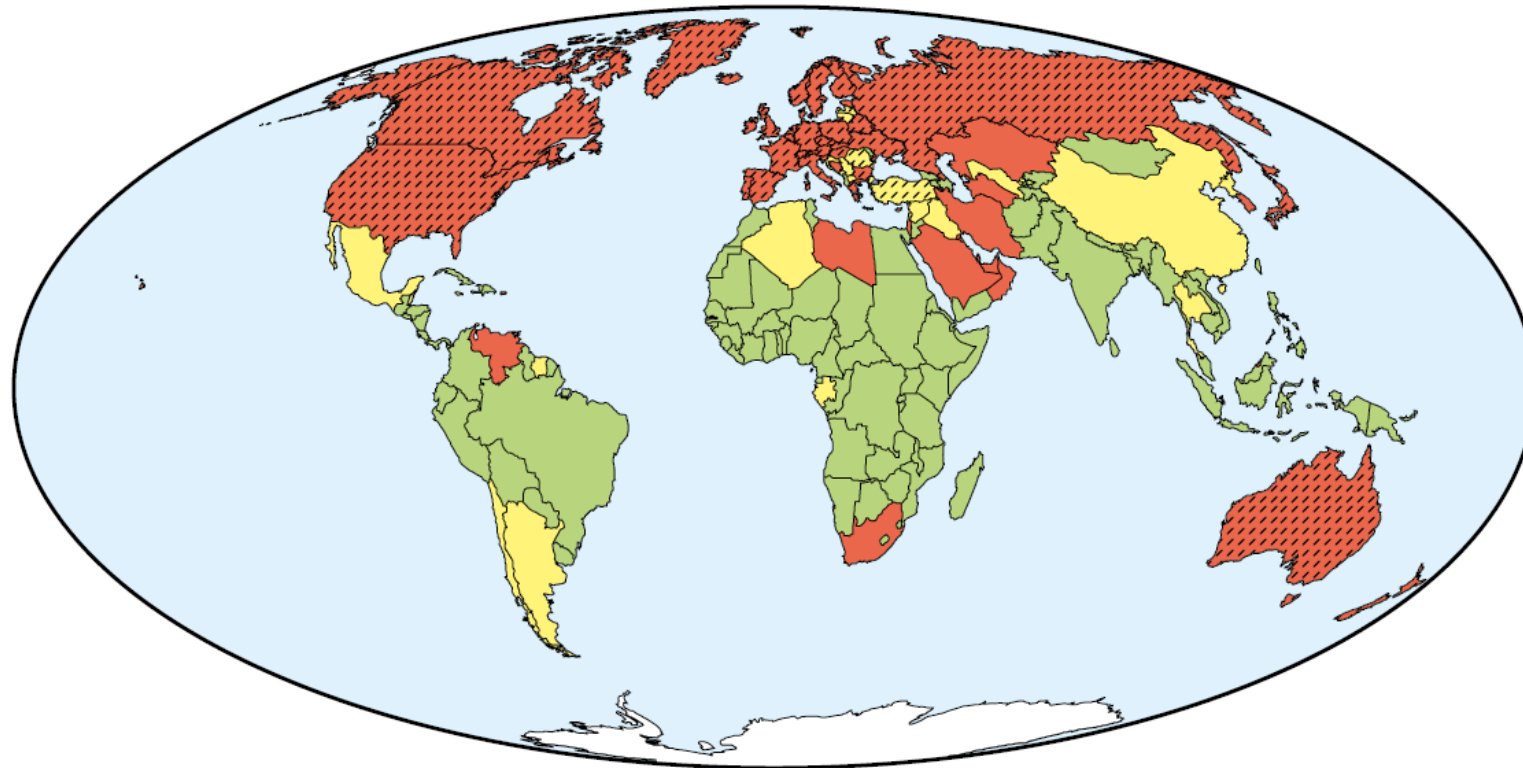
CO<sub>2</sub> emissions in 2008 (light green) and permissible average annual budgets (dark green) according to the WBGU approach for selected countries.


# Examples of theoretical emission trajectories





Examples of equal per-capita emissions of selected countries for 2010 - 2050, **without emissions trading**. Trajectories start from current emission levels.


# CO<sub>2</sub> emissions by country



 Countries with per-capita CO<sub>2</sub> emissions above 5,4 t

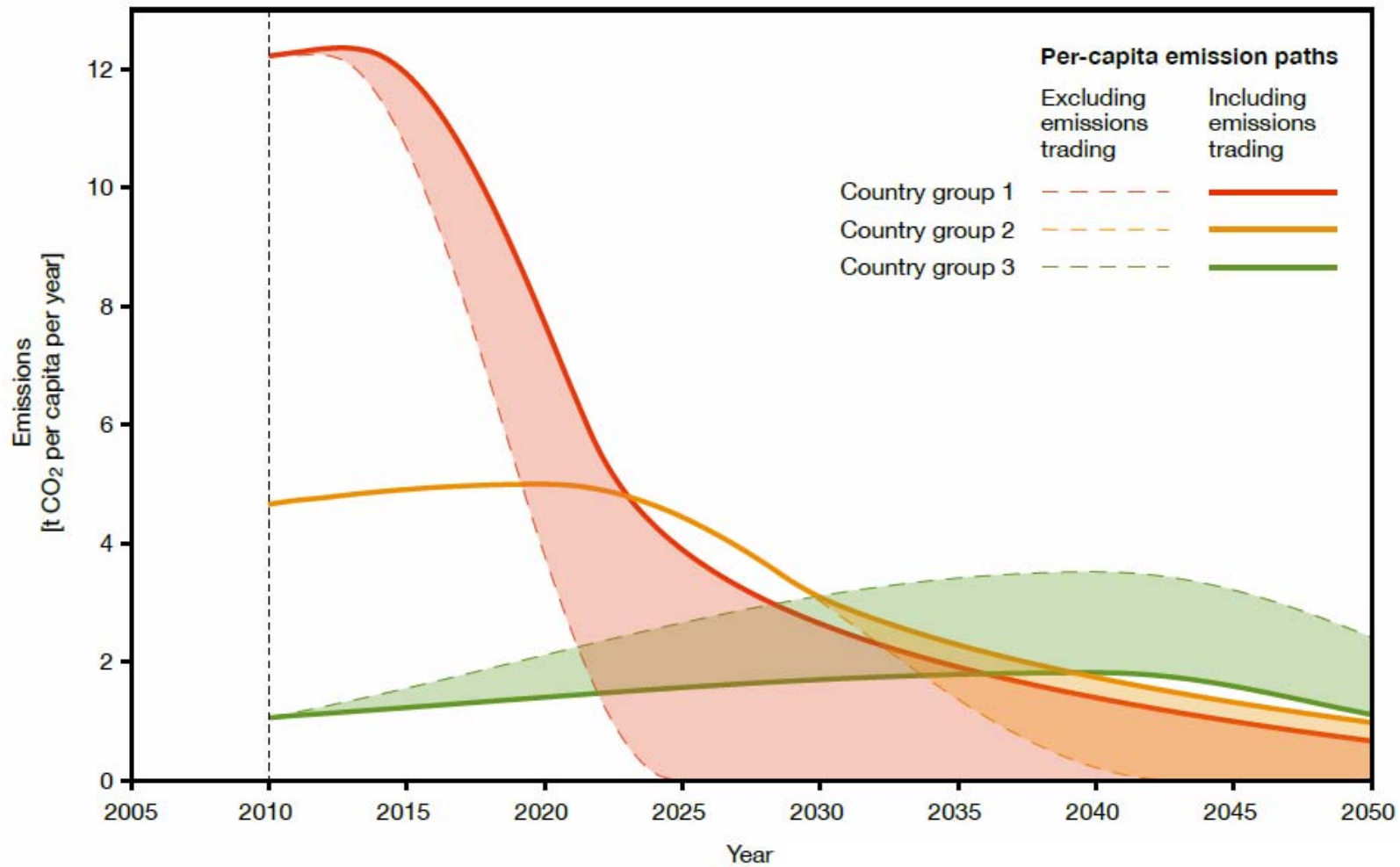
 Annex I countries

 Countries with per-capita CO<sub>2</sub> emissions of 2,7–5,4 t

 Countries with per-capita CO<sub>2</sub> emissions below 2,7 t

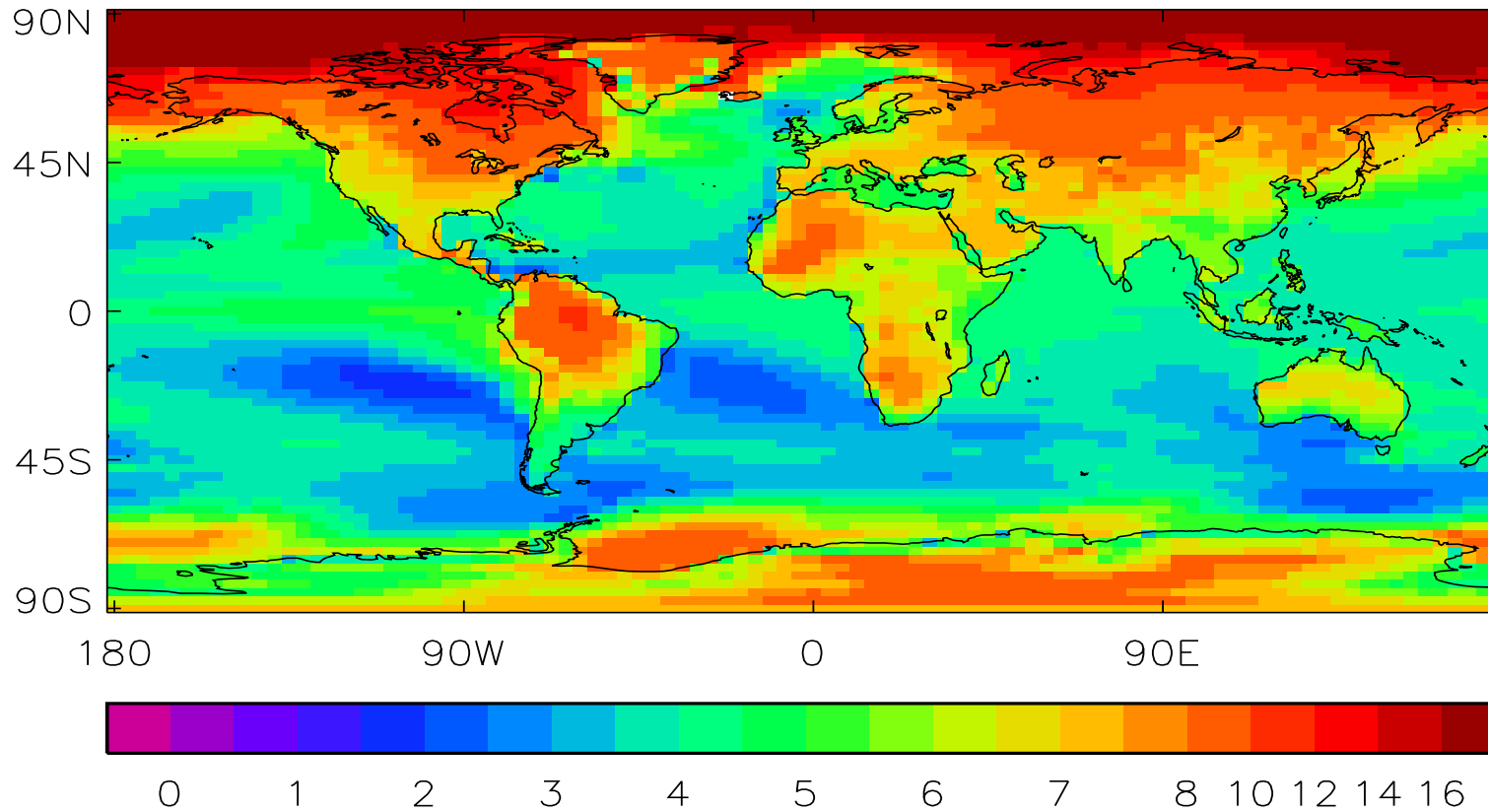
Per-capita CO<sub>2</sub> emissions in 2005, differentiated by emission levels and country.

# Examples of Per-Capita Emissions Paths of CO<sub>2</sub> for Three Groups of Countries ~~without~~ **with** Emissions Trading



Source: WBGU Special Report 2009

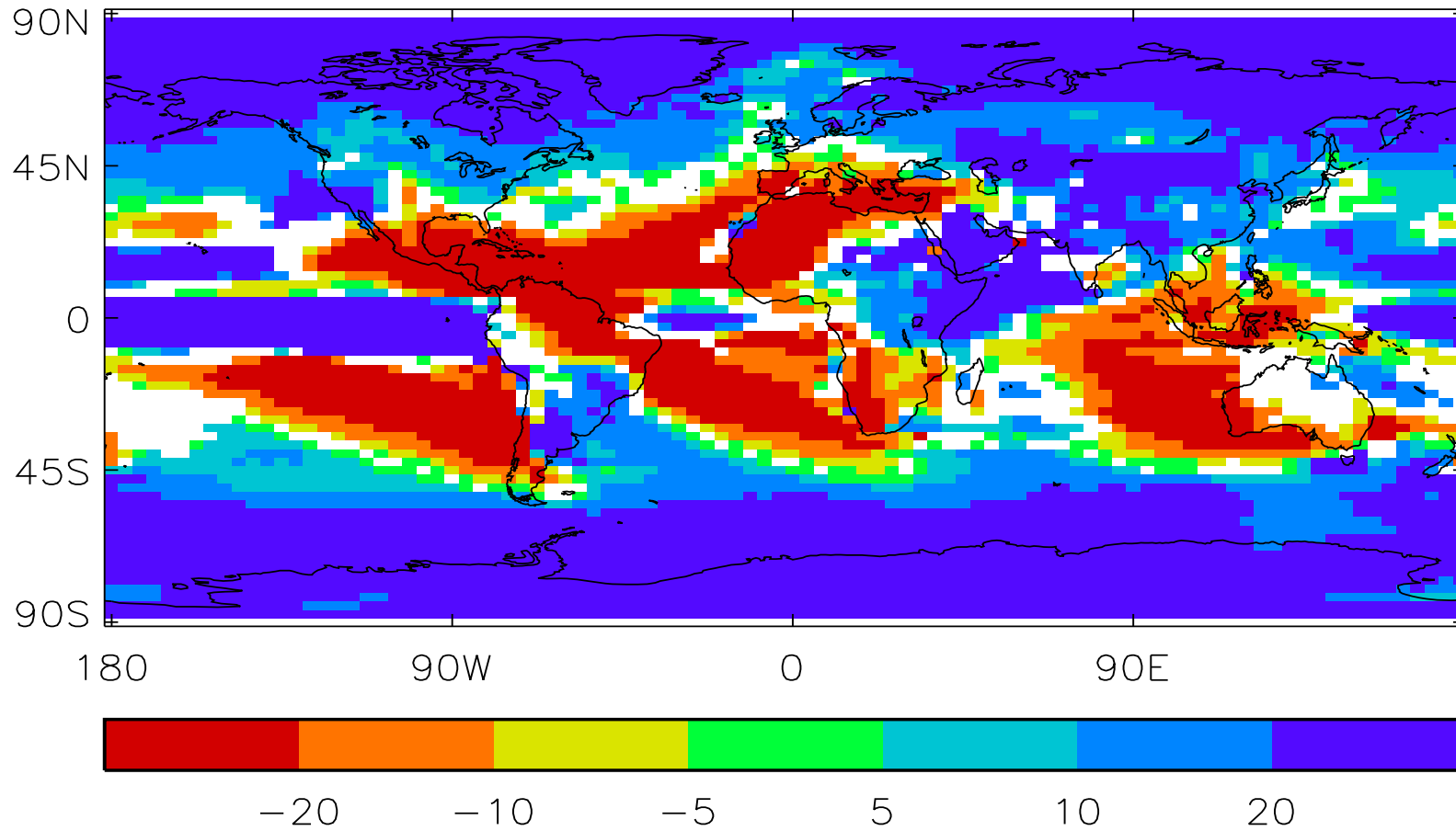
# Pattern of warming by 2090s, A1FI Mean of “high-end” MOHC simulations (14 simulations, mean global warming 5.4°C)



Temperature change (°C) relative to 1961-1990

**Source: Met Office  
Hadley Centre**

**Precipitation changes by 2090s, A1FI Mean of  
“high-end” MOHC simulations (14  
simulations, mean global warming 5.4°C)**

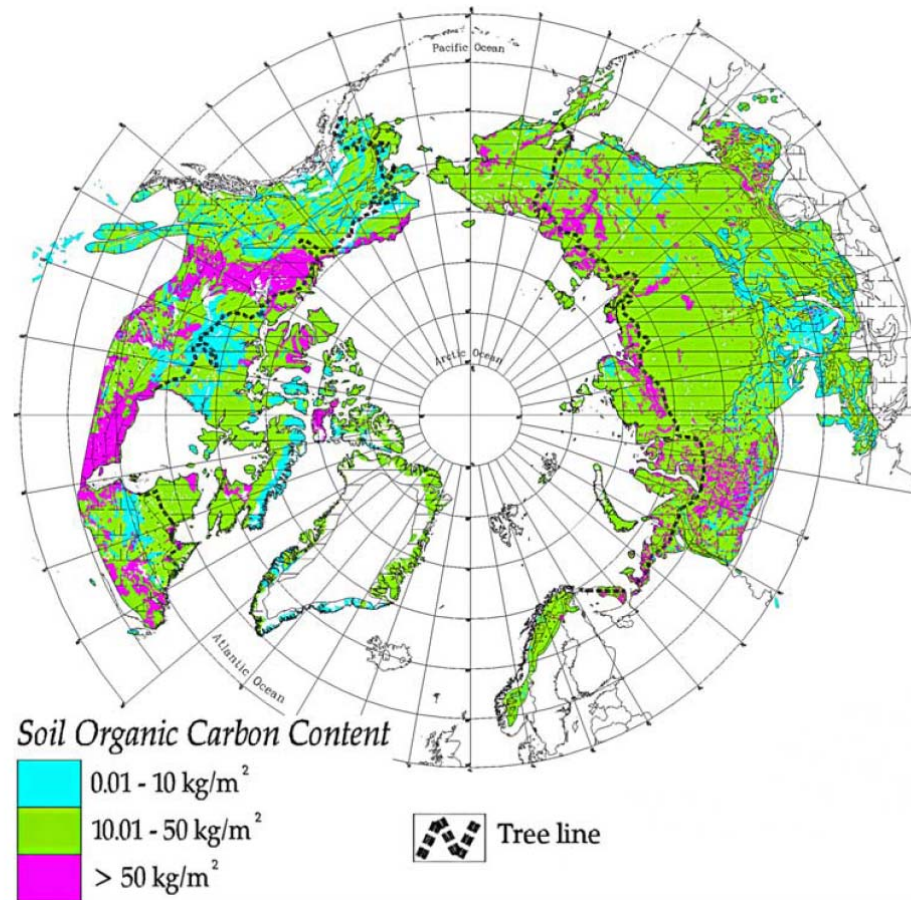


**Source: Met Office  
Hadley Centre**



# Carbon Stored in Permafrost Soils

## Estimates Corrected Upwards

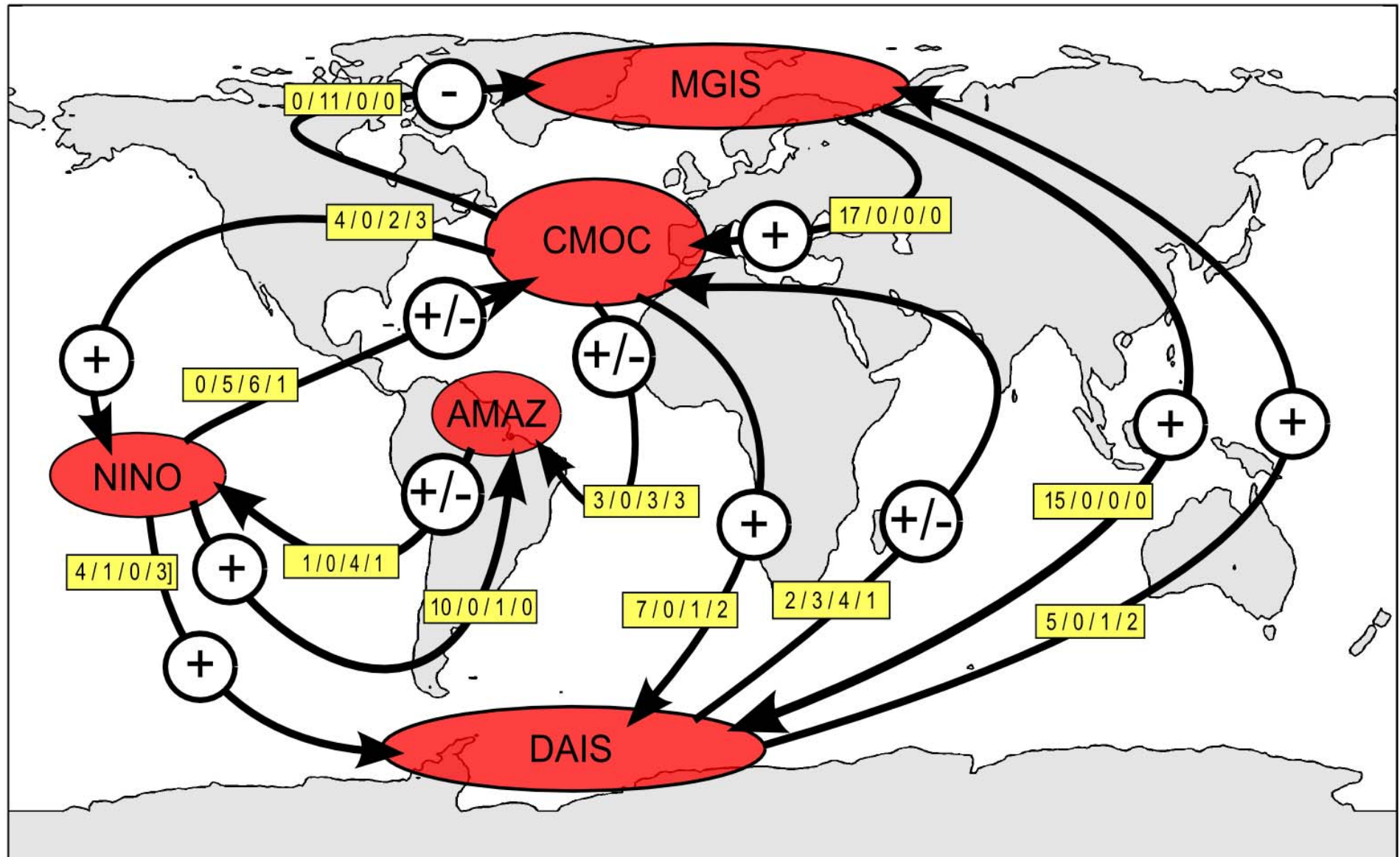


The new estimate of frozen carbon stored in permafrost soils of the circumpolar region is over 1.5 trillion tons, about twice as much carbon as contained in the atmosphere.

(Tarnocai et al. 2009 Global Biogeochemical Cycles)



# Interdependency Between Tipping Points



(Kriegler et al. 2009 PNAS)

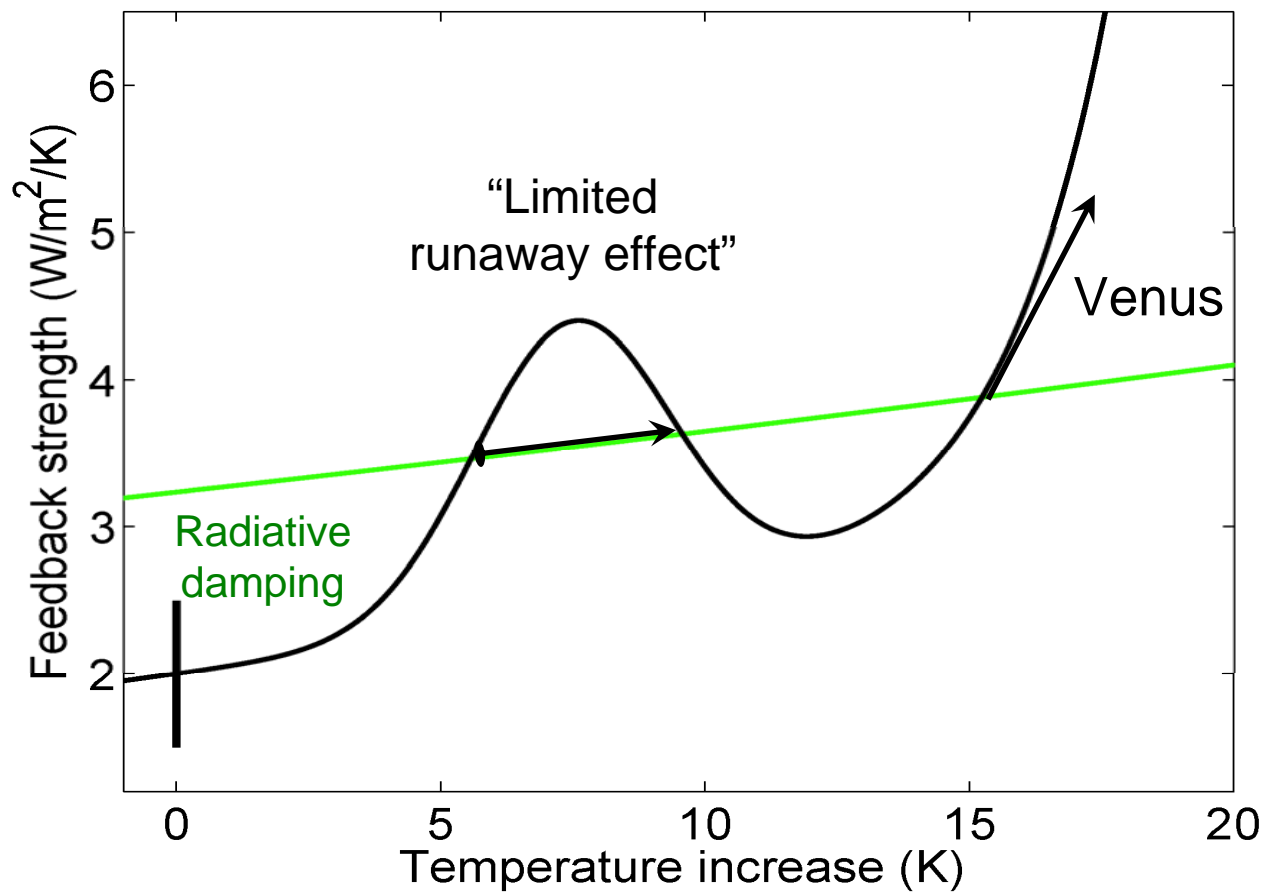
# “Runaway Greenhouse Effect”

## Conceptual approach

Energy gain per additional degree of warming [ $\text{W}/\text{m}^2/\text{K}$ ]

vs.

Energy export through thermal radiation

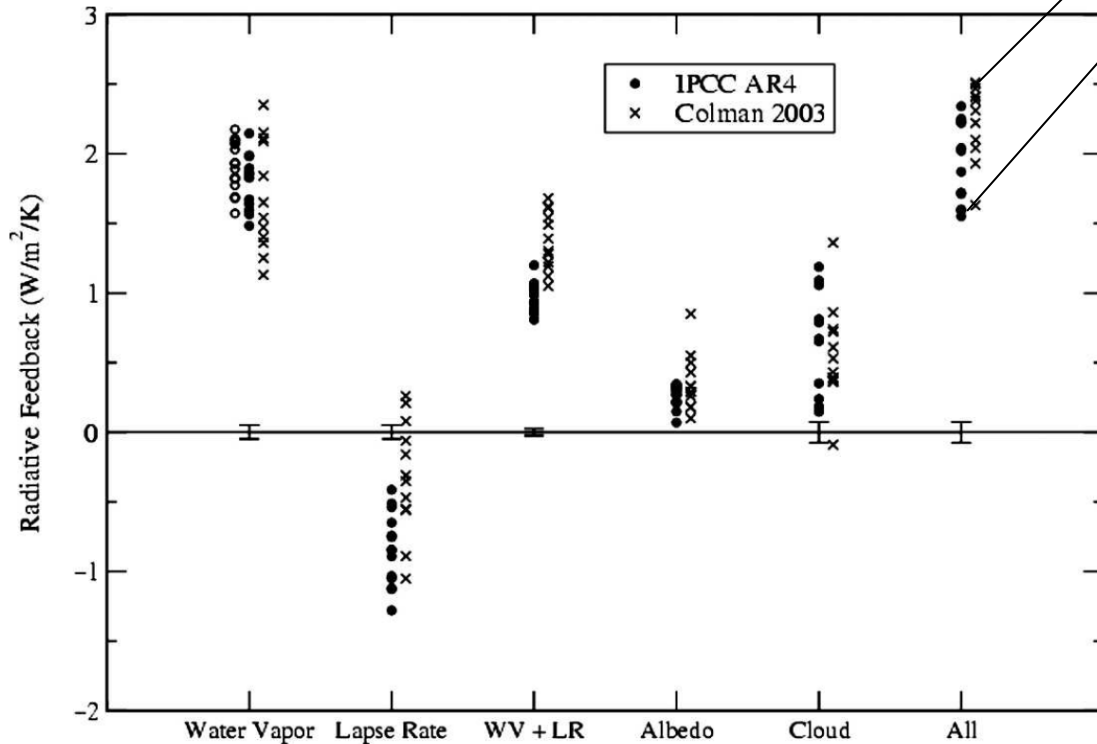
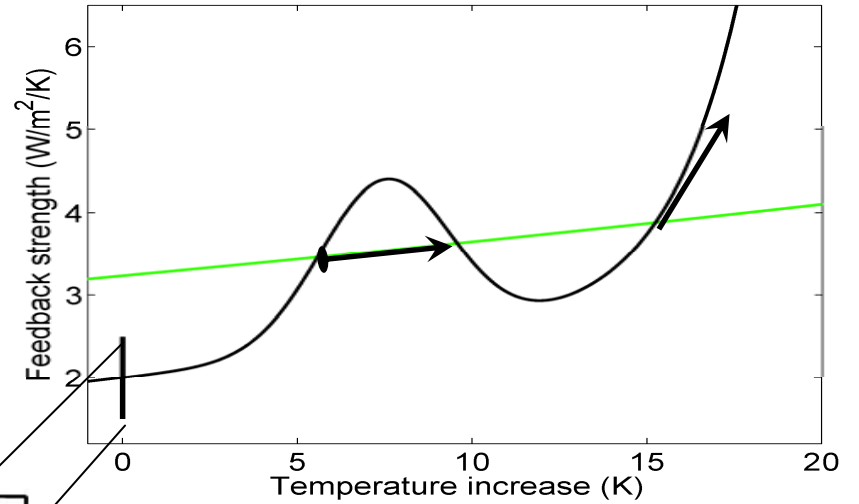


(Levermann & Schneider v. Deimling, pers. comm., 2009)

# “Runaway Greenhouse Effect”

## Where do we stand at present ?

Present estimate of  
**physical** feedbacks  
1.5 – 2.5 W/m<sup>2</sup>/K



Distance to Runaway Limit  
0.7 – 1.7 W/m<sup>2</sup>/K

(Soden & Held, *J. Clim.*, 2006)





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“Action for a Low Carbon and Equitable Future”

London, UK, 26 – 28 May 2009



## MILESTONES of the Great Transformation

An effective and just global agreement on climate change

A low carbon infrastructure

Forest protection, conservation and restoration



„[...] we should confine the temperature rise to 2°C to avoid unmanageable climate risks. This can only be achieved

- with a **peak of global emissions** of all greenhouse gases **by 2015**
- at least a 50% emission reduction by 2050 on a 1990 baseline. [...] developed countries have to aim for a 25-40% reduction by 2020.

[...] a **total carbon budget** [...] should be accepted as the base for measuring the effectiveness of short-term (2020) and long-term (2050) targets“



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**Memorandum Signatories**

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1	Professor Peter Agre	Chemistry 2003	United States
2	Professor Kenneth Arrow	Economics 1972	United States
3	Professor Françoise Barré-Sinoussi	Medicine 2008	France
4	Dr Paul Berg	Chemistry 1980	United States
5	Dr Mario Capecchi	Medicine 2007	United States
6	Professor John Coetzee	Literature 2003	South Africa
7	Professor Paul Crutzen	Chemistry 1995	Germany
8	Professor Johann Deisenhofer	Chemistry 1988	Germany
9	Dr Mohamed ElBaradei	Peace 2005	Austria
10	Professor Claude Cohen-Tannoudji	Physics 1997	France
11	Professor Peter Doherty	Medicine 1996	Australia
12	Professor Richard Ernst	Chemistry 1991	Switzerland
13	Professor Dr Gerhard Ertl	Chemistry 2007	Germany
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26	Professor Aaron Klug	Chemistry 1982	United Kingdom
27	Professor Walter Kohn	Chemistry 1998	United States
28	Professor Masatoshi Koshihata	Physics 2002	Japan
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36	Professor Dr Hartmut Michel	Chemistry 1988	Germany
37	Professor James Mirreles	Economic Sciences 1996	United Kingdom
38	Professor Mario Molina	Chemistry 1995	United States
39	Professor Roger Myerson	Economics 2007	United States
40	Professor Doctor Erwin Neher	Medicine 1991	Germany
41	Dr Ryoji Noyori	Chemistry 2001	Japan
42	Sir Paul Nurse	Medicine 2001	United Kingdom
43	Professor Douglas Osheroff	Physics 1996	United States
44	Dr. Rajendra Pachauri on behalf of IPCC	Peace 2007	India
45	Professor Edmund Phelps	Economic Sciences 1996	United States
46	Professor John Polanyi	Chemistry 1986	Canada
47	Professor David Politzer	Physics 2004	United States
48	Professor Burton Richter	Chemistry 1976	United States
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51	Dr Hideki Shirakawa	Chemistry 2007	Japan
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